

ART. IX.—*On a Deposit of Diatomaceæ at South Yarra.* By
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[Read before the Royal Society of Victoria, October 8th, 1860.]

At the last meeting of the Royal Society, some microscopic organisms were exhibited by my friend, Mr. Ralph, from the mud of a swamp near the Yarra, where the Melbourne and Suburban Railway crosses that river. During the interval that has intervened, this deposit has been the subject of more careful and extensive examination, and in the results which I have the honor to submit to your inspection this evening, it will be shown that in the locality of South Yarra there is a vast and interesting field of infusorial remains, containing a numerous variety of microscopic objects, not less remarkable for their exquisite beauty and delicacy of structure, than for the extreme profusion in which they are to be found. These remains are generally silicious, and the extraordinary preservation which they exhibit is due to this circumstance.

On the southern bank of the river Yarra, where the railway operations are in progress, an embankment has had to be carried across a small swamp to the bridge now in course of erection. This swamp has its termination in the Yarra, at a short distance to the westward of the line of railway, and extends in a south-easterly direction beyond the Gardiner's Creek Road, serving as an outlet to the watershed of a large portion of the municipal district of Prahran. As the material to form the embankment alluded to was thrown upon the surface of the swamp, the weight of the super-incumbent earth, assisted by occasional heavy rains, burst up the soft and spongy matter of the bog, and totally obstructed the drainage, to which a reference has just been made. In order to provide a remedy, the Railway Company have been necessitated to dig up this boggy earth, preparatory to the formation of a permanent outlet to the river; and in the material thus removed have been found those microscopic and other organisms which are now brought under the cognizance of the Society. Several specimens of the deposit are placed upon the table this evening. In some of these, marine shells, more or less perfect, pieces of cuttle-fish bone,

and the debris of echini, are obvious to the unassisted vision; and by the aid of a common magnifier, numerous foraminiferous shells are also readily apparent. In other specimens these larger objects become more rare, and their place appears to be supplied by an increased number of microscopic forms of the *Diatomaceæ*, which are occasionally met with in such infinite profusion as to give the semblance of frosted silver to the eye, and to render, in a remarkable degree, the mass in which they are contained specifically lighter than water. In every piece of this mud which has come under observation, these diatoms have been found in greater or less abundance; and from inquiries that have been instituted, it is estimated that the swamp has a depth of not less than sixty feet! How vast has been the extent of life within this limited area, and how immeasurably the results of actual examination of the exquisite beauty and delicate tracing of these minute organisms transcend any ordinary efforts of imagination to conceive, can only be appreciated by the revelations of the microscope.

The great improvements which have been effected during the last few years in the achromatic microscope, the perfection and precision to which it has attained as an instrument of the highest value in the prosecution of scientific research, and the increased and daily increasing numbers of those who resort to its assistance in the pursuit of special branches of study, or particular objects of inquiry, are rapidly enlarging the boundaries of our knowledge in every portion of the world, and in every department of philosophical investigation. It has been well remarked that he who sees with the naked eye only sees but half that world which God has made. Beyond the limit of man's natural vision the microscope has disclosed another world whose first characteristic consists in the minuteness of its organisms; but in the study of those apparently insignificant forms, have been solved some of the highest problems in the history of organization. Hence, the family of the *Diatomaceæ* has many points of peculiar interest. Their presence in almost every running stream, in every little pool of stagnant water, as well as in the lowest depths of the ocean, their use and application, as the severest tests of the excellence and efficiency of our microscopic object-glasses—the inconceivably delicate and minute markings of the silicious coverings of many of their forms—the peculiarities of their structure, development, and reproduction—and the wonderful offices which they perform in the admirable eco-

mony of infinite wisdom and intelligence, as "the invisible scavengers of nature," have made them the subjects of delightful and instructive study, wherever the means of their examination by the microscope have extended. "As a group of simple organisms they present us with the first struggles of life against the physical and chemical forces of mere matter; and it is by the observation and determination of these elementary forms that we are enabled to proceed, in the spirit of true philosophy, to the accurate investigation of higher forms of structure; and thus the theory of cell-formation, as carefully elaborated under the scrutiny of the microscope, has become the foundation of all our certain knowledge of vegetable organization."

These objects, then, so apparently trivial to ordinary observers, possess a degree of interest, actual and relative, which is far beyond their nominal position in the scale of scientific arrangement. In the present state of our nomenclature, the family of the *Diatomaceæ* occupies a kind of anomalous situation between the animal and vegetable kingdoms, in exhibiting certain characteristics of both. Ehrenberg and some other microscopists have placed them among the lowest forms of animal life; while the late Professor William Smith, in his laborious monograph of the British *Diatomaceæ*, Professor Carpenter, and a host of other celebrated observers, have unhesitatingly described them as belonging to the vegetable kingdom. The preponderance of opinion undoubtedly inclines to their vegetable nature, notwithstanding the power of independent locomotion, and the presence of ciliary actions, which some species have been ascertained to exhibit. Whatever doubt may exist on this subject, appears to arise from the difficulty of reconciling the movements which accompany the vital functions of the *Diatomaceæ* with the prevalent conditions of plant life, and of harmonizing their silicious epiderms with the ordinary forms under which cellulose occurs throughout the vegetable kingdom. On the other hand, it will be remembered that most decided movements are present in the *Oscillatoria*, and that silica is ever constant in the structure of the epiderm of the *Equisitaceæ* and the *Graminaceæ*. An enlarged consideration of these and other facts, therefore, conduces to the view that the *Diatomaceæ*, with specialities of their own, have intimate alliances with the other orders of Unicellular Algæ, and belong to the vegetable, rather than the animal kingdom.

The forms which these objects present in a living state

are exceedingly various. Some are filamentous, and in the early stages of their growth very closely resemble the *Confervæ*. Instead of the usual ochreous brown colour of their cell-contents, a batch of *Melosira*, which I lately found in a brackish pool near the Yarra, exhibited a bright confervoid green in the younger filaments, but gradually passing into the normal brown, as the more perfect orbicular characters of the frustules become developed. Other genera are connected by the angles of their frustules, in a kind of zig-zag chain, disrupted by the slightest touch, from which arises the term of "Brittleworts" in common vernacular language, as descriptive of the whole family. Other forms again are invested with a gelatinous envelope, resembling that which is found to exist in some genera of the *Desmids*; while by far the greater number is composed of single frustules only, becoming duplicate in the process of self-division, which characterizes this and its allied families.

The circumstances attending the remarkable preservation of these minute and delicate organizations are deserving of notice. The silicious epiderm by which they are invested, has served to perpetuate their forms in numerous localities from which they have long since disappeared in a living condition. In several places in the British Islands, in Europe, Africa, America, and the Indies, familiar by name at least to the microscopist, the long-hidden records of infusorial organisms have been disintombed, since the silica of which their frustules is composed forms one of the least perishable materials with which we are acquainted. The city of Richmond, in Virginia, is said by Professor Smith to be built upon a stratum of these remains, eighteen feet in thickness; and extensive tracts, even in the Arctic and Antarctic regions, have been stated to be formed of similar deposits. It is with some degree of satisfaction that the name of South Yarra is now added to the list of these remarkable places, as a rich habitat of the fossil *Diatomaceæ* in Victoria; and with the hope that, while these varied and beautiful objects afford that pleasure which, in scientific pursuits, has its own reward, they may also serve to train the eye and mind to habits of correct and careful observation in our young microscopists, and stimulate to still higher and nobler fields of investigation.

The deposit, when it is recently turned up, has in general a very dark appearance, and the consistence of a soft tenacious clay. After a few days exposure to our warm summer weather, it dries into a greyish coloured substance, and becomes

occasionally so light and friable, that the passing breeze will often float away the loosened diatoms from the surface of the specimen under examination. Mixed with other clay, it has been used for making bricks, but during the process of burning, the amount of contraction and distortion which supervened rendered them utterly worthless for economical purposes, but exceedingly interesting and beautiful as opaque microscopic objects. In separating the diatoms, the ordinary routine has been followed, which is described in the *Quarterly Journal of Microscopic Science*. Repeated washings in water will be necessary as a preliminary operation, and then the action of acids and chlorate of potash, to clean the objects from the organic matters which accompany them.

In a former part of this paper allusion has been made to the presence of undoubted marine shells, and of numbers of *Foraminifera* in certain portions of this deposit; and it is also worthy of observation, that the clay in which these most abound, is characterised by fewest of the *Diatomaceæ*. It seems therefore an obvious and rational conclusion, that at one time, probably not very remote, the waters of Port Phillip Bay must have covered this locality. Subsequently, as the land became elevated, and the communication with the sea interrupted, but not altogether closed, it is not improbable that here was formed a sort of lagoon, or salt-water marsh, highly favourable to the growth and development of the *Diatomaceæ* in immense myriads. That this period must have been one of considerable duration, seems evident from the large quantities of their silicious shields in particular parts of the deposit; and during the further elevation of the land, it is possible that an interruption of fresh water into this lagoon suddenly destroyed the vitality of the organisms, leaving their remains in exquisite preservation, as a rich legacy to microscopic science.

In the careful examination of this deposit, upwards of fifty different forms of diatoms may be found, in addition to spicula of sponge, and the object known as *Dictyocha*. While some of the forms are exceedingly rare, others are very abundant; among which is the beautiful species of *Actinocyclus*, to which I have ventured to give the name of His Excellency, the President of this Society.

1. *Actinocyclus Barklyi*. Valve convex, with central nodule; striæ moniliform, arranged in radiating lines, and diminishing in number towards the centre; no pseudo-marginal

nodule; margin of the valve having fine markings, direct and oblique; diameter of frustule .0111 to .0074.

2. *Actinocyclus* *dnodenarius*.
3. *Coscinodiscus* *radiatus*.
4. *Coscinodiscus* *eccentricus*.
5. *Campylodiscus* *clypeus*.
6. *Campylodiscus* *cribrosus*.
7. *Campylodiscus* *Hodgsonii*.
8. *Campylodiscus* *parvulus*.
9. *Stauroneis* *pulchella*.
10. *Stauroneis* *acuta*.
11. *Hydrosera* *triquetra* (*rare*).
12. *Navicula* *elliptica*.
13. *Navicula* *ovalis*.
14. *Navicula* *Amphisbœna*.
15. *Navicula* *tumens*.
16. *Navicula* *pusilla*.
17. *Navicula* *minutula*.
18. *Navicula* (*new variety*). Valve elliptical, extremities rounded, striæ transverse in lateral and two narrow central bands, delicate, 34 in. .001".
19. *Pinnularia* *nobilis*.
20. *Pinnularia* *major*.
21. *Pinnularia* *stauroneiformis*.
22. *Pinnularia* *distans*.
23. *Pinnularia* *acuminata*.
24. *Orthosira* *marina*.
25. *Melosira* ———
26. *Hyalodiscus* *subtilis*. Valve having a central granulated disc, with clear transparent margin, with fine decussating markings; diameter .01 to .0074.
27. *Pleurosigma* *Balticum*.
28. *Pleurosigma* ———
29. *Pleurosigma* ———
30. *Surrirella* *splendida*.
31. *Surrirella* *striatula*.
32. *Gomphonema* *lanccolatum*.
33. *Gomphonema* *cymbiforme*.
34. *Epithemia* *turgida*.
35. *Epithemia* *Westernannii*.
36. *Himantidium* *arcut*.
37. *Himantidium* *undulatum*.
38. *Himantidium* *bidens*.
39. *Himantidium* *gracile*.

- 40. *Achnanthes brevipes*.
- 41. *Achnanthes subsessilis*.
- 42. *Tryblionella gracilis*.
- 43. *Tryblionella marginata*.
- 44. *Cyclotella rectangula*.
- 45. *Cocconeoma lanceolatum*.
- 46. *Syncdra*, three forms; *Tabellaria*, *Cymbella*, *Nitzschia*, *Cocconeis*.

ART. X.—*Manners and Customs of the Australian Natives, in particular of the Port Lincoln District.* By CHARLES WILHELMI, Esq.

[Read before the Royal Society, October 29, 1860.]

ALTHOUGH Australia, for a considerable time already, is known to the world in general, very little, comparatively speaking, has as yet been made known respecting the habits and customs of its aboriginal inhabitants; very few persons indeed have given themselves the trouble to note down what they may have seen or may have been told by these children of nature, in order that those who have not had such opportunities may be enabled to form a correct idea respecting them.

My various botanical journeys, since 1849, have necessarily brought me in frequent contact with them, when it always has been most interesting to me closely to watch the different customs and habits of this race of mankind.

During my two visits to Port Lincoln, I have had many opportunities for making observations respecting the natives there, which were the more interesting, as these people, at that time, had as yet been so little interfered with by civilization.

To the Rev. Mr. Schurmann, however, I am most particularly indebted for his valuable communications on this subject.

This gentleman, in 1840, about twenty-one years ago, had been appointed Protector of the aborigines of Port Lincoln, and has occupied this office for nearly six years. After